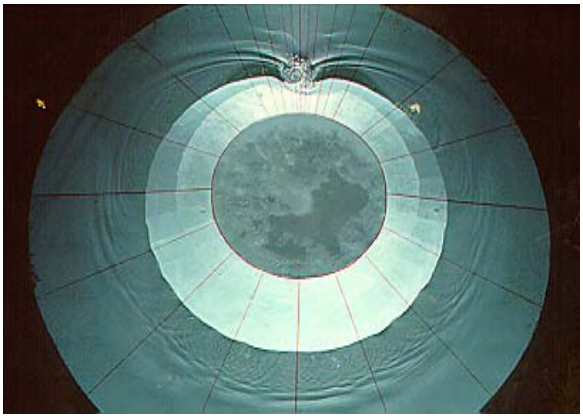
US Army Corps of Engineers®
Engineer Research and Development Center

Directional Spectral Wave Generator (DSWG)

Purpose

Experts at ERDC's Coastal and Hydraulics Laboratory (CHL) provide realistic three-dimensional waves in a laboratory environment for coastal research and site-specific project studies with a Directional Spectral Wave Generator (DSWG). USACE Districts and Divisions, as well as academia and private consulting companies, are able to use this wave-maker facility, which helps them understand the complex wave environment due to directional spectral waves and their impact on beaches, harbors, coastal structures, and ships. Typical applications are wave transformation, harbor and breakwater modeling, ship underkeel clearance, wave-current interaction, wave-wave interaction, underwater explosions, submarine and aircraft carrier stability, and tsunami waves.



Overall view of Directional Spectral Wave Generator

Specifications

The DSWG is a state-of-the-art multidirectional wave maker. It is 27.4 m long and consists of 60 paddles, each 46 cm wide and 1 m high. Each paddle is driven at the joints by an electrical motor in piston mode, producing smooth, clean model waves. The stroke of ± 36 cm generates wave heights up to 30 cm in 60-cm water depths. Angles between paddles can be continuously varied using the "snake principle" to produce waves at angles approaching ± 85 deg. The DSWG comprises four modules that enhance portability. Passive wave absorber frames around the basin perimeter and active wave absorption on the DSWG reduce reflection from model structures and basin walls. Two hydraulic gates facilitate model construction and access.

Benefits

Significant cost savings and efficiency are achieved through simulation of real-world wave environments. More efficient designs are produced in studies that use this facility, resulting in reduced costs. Also potential problems can be predicted and subsequently avoided through the study of wave interaction.

Success Stories

The DSWG has been widely used by research and academic communities throughout the country. Projects that have involved the DSWG include:

- Lajes Air Force Base, Lajes, Azores, breakwater repair. This base is located in the Azores Islands in the mid-Atlantic Ocean where the harbor has direct exposure to severe open Atlantic storms. Despite continuous repairs through the years, the structure continued to deteriorate. CHL designed and constructed a physical hydraulic model to study repair scenarios using the armor layer Core-Loc™. Tested options have been entirely stable.

- Barber's Point, Hawaii. Simulations for design vessel transits through the entrance channel and into the harbor were made for selected wave conditions. Harbor expansion design for safe navigation was also achieved through research using this facility.

- Tsunami runup studies. Tsunamis are long water waves generated by impulsive geophysical events on the ocean floor or at the coastline. The runup can produce widespread disaster. In the mid-1990's, CHL researched tsunami runup for the National Science Foundation to provide a better understanding of this physical phenomenon and to verify numerical models used in predicting tsunami wave runup on beaches, islands, and vertical walls. Many journal articles and international recognition followed.

- Wave Engineering Tests (WET). Wave transformation data on and around a submerged elliptical shoal was obtained for a variety of wave conditions. These data have been used extensively to validate numerical models. Many journal articles and international recognition have followed.

Point of Contact

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